DOCUMENT RESUME

ED 228 997 IR 010 672

AUTHOR Krishnakumar, Parameswar; Chisholm, Thomas Alexander
TITLE An Analysis of Team Composition as It Affects Simulation Performance.
PUB DATE 79
NOTE 23p.; Paper presented at the Annual Conference of the North American Simulation and Gaming Association (19th, October 1979).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Achievement; Business Education; College Students; *Decision Making; Higher Education; Marketing; *Organizational Effectiveness; *Sex Differences; *Simulation; *Teamwork
IDENTIFIERS *Simulation Games

ABSTRACT

This study investigated the extent to which sex composition and average team academic achievement of student simulation teams affect team effectiveness. Seventy-four students in two sections of a marketing principles class were divided into 20 teams to test their decision-making skills. For 10 weeks, each team operated a simulated supermarket using the Quaker Oats version of the Purdue Supermarket Game. Four teams were all female, six were all male, and ten teams were mixed. The measure of team effectiveness was the degree of profitability achieved by each team at the end of the 10-week period. In terms of the degree of profitability averages, the 4 all-female teams performed best, followed by the 6 all-male teams, with the 10 mixed teams doing the least well. The average team academic achievement appears to be unrelated to team performance. Results indicate that while there are some significant differences, additional research in this aspect of student simulation participation is still needed. (Author/LMM)

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AN ANALYSIS OF TEAM COMPOSITION AS IT AFFECTS SIMULATION PERFORMANCE

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ABSTRACT

This study investigates the extent to which sex composition and average team academic achievement of student simulation teams affect team effectiveness. Seventy-four students in two sections of Marketing Principles were divided into 20 teams. For ten weeks each team operated a supermarket according to the Purdue Supermarket Game. Four teams were all female, six teams were all male, and ten teams were mixed. The measure of team effectiveness was the degree of profitability achieved by each team at the end of the ten week period. The report charts week to week performance for each team. The statistical tests indicate that while there are some significant differences among the teams in terms of results it appears that additional research in this important aspect of student simulation participation is warranted. In terms of the degree of profitability averages the four all female teams performed best followed by the six all male teams with the ten mixed teams doing the least well. The average team academic achievement appears to be unrelated to team performance.

AN ANALYSIS OF TEAM COMPOSITION AS IT AFFECTS SIMULATION PERFORMANCE

The philosophical and intellectual foundations for this research are derived from a more general research topic which has been pursued by the authors for a number of years. As extensive users of classroom computer based simulations it was logical for the authors to seek to develop some way of measuring or determining the effectiveness of simulations in furthering various academic objectives. The earliest pursued by the authors was an attempt to investigate student attitudes towards the use of simulations in the classroom. The rationale for such research was predicated on the concept that as consumers of a product called simulation they, the users, should have a reasonably adequate idea of the usefulness of simulation exercises. Thus the earliest of the author's publications in this area sought to answer some basic questions related to student perceptions as to the general effectiveness of classroom simulations (2).

In an attempt to achieve a deeper explanation of student attitudes a subsequent study analyzed the responses of 130 student participants in computer based simulation in terms of the grade point average, year in school, the number of previous exposures to simulations, and the type of simulation used (1). This latter aspect of the cross tabulations was particularly relevant in that the students were participants in one of three different simulations. Each of these simulations was in turn analyzed for specific factors in an attempt to arrive at an index of student satisfaction (4). As these and other analyses proceeded the authors became interested in a peripheral topic.

BACKGROUND

Increasingly, in education literature, researchers are asking questions which relate to the unique problems facing female students who are seeking to pursue college level courses in traditionally male dominated curricula. A number of articles have addressed themselves to this point. Shapley (13) and Cobb (4) approach the issue from the direction that the problem is more one of social and cultural bias than any inherent bias in the educational process or in the educational institutions. Other authors such as Greenberg (8) and Troutman (15) believe searching for reasons is not as important as establishing policies and practices which will alleviate the existing situation. Nihlen believes that before prescriptions can be arrived at, it is necessary to identify peculiarly female learning styles, and from these develop some useful college curriculum variations to accommodate the differences (12). More specifically, Keller assumes the existence of the difficulties and maintains there are a list of attitudinal changes which must be achieved by institutions of higher education if they are to meet adequately the educational and career expectations of both men and women students (10).

The authors of this paper have connected the aforementioned identified educational problems with the changing composition of business classes. Increasingly, the previously preponderantly male enrollment in schools of business is changing radically. The National Center for Educational Statistics in its most recent report reveals a 240% increase in the number of women receiving bachelor degrees in business between the years 1968 and 1976 (16). There is no reason to believe this extensive change has reversed itself or even slowed perceptably.

In addition the intellectual foundations for this research paper are derived from an increasingly popular area of social investigation. It has

been postulated and in some cases strongly presented that achievement by women in occupational areas previously reserved for men encounters some formidable social pressures. Thus Hagen and Kahn came to the conclusion in their study that a woman who behaves in a competent manner disconfirms sex role expectations and, as a result, more often than not, suffers one of two societal reactions: (a) she is disliked and/or excluded from the informal group or (b) her performance is discounted by being attributed to chance (9). Similar conclusions were reached by Deaux and Emswiller (5). More specifically Feather concluded that success in employment situations is viewed more positively by managers if such success is consistent with sex role expectations. Feather identified this typical reasoning in the prevalent practice of not so heavily penalizing unsuccessful women as in the case with unsuccessful men; conversely, highly successful women are not rewarded as highly as similarly successful men (6). Other studies following a similar direction are the works of Lao, Upchurch, Corwin, and Grossnickle (11), and Stein and Bailey (14). The studies of Frank and Drucker used an in-basket technique and concluded there were no significant differences in the "blind rating" of men and women participants in the exercise (7).

Given the facts that: (a) female students do encounter learning or educational difficulties in mathematically oriented subjects, (b) there is an increasing number of female students entering business programs which involve the use of simulations and to some extent statistical analyses, and (c) there are readily identifiable socially based biases which work to the detriment of women in the work force, it appeared logical to the authors that there was sufficient justification to embark on a research project related to the three general topics noted above.

OBJECTIVES

The research being presented here is an outgrowth of a more general investigation pursued by the authors. This recent investigation showed there were significant differences in the attitudes between men and women students in terms of the perceived effectiveness of classroom computer based simulations (3). The authors and others with whom they discussed this topic of sex based differences in simulation perception thought it would be useful in terms of understanding student reactions to investigate the impact that the sex composition of simulation teams had on the effectiveness of simulation teams. It was determined that a simple measurement of team effectiveness would be the first place to begin the search. Thus the question was posed as to whether there were any observable differences in the success of the teams as measured by the results of the simulation. Logically the next question was whether the team performance differential could be connected with the sex distribution in the particular teams. In other words would teams which were comprised of members of the same sex do better in the simulation than would teams of mixed sex. Correlatively, would a team of females outperform a team of males? In every case the definition of "better" or "more effective" had to mean "in terms of the parameters of the simulation." The basic assumption for this research is that successful teams operate profitable supermarkets; conversely, chronic and/or serious losses are to be equated with ineffective performance.

METHODOLOGY

All the student participants were involved in the Purdue Supermarket Game. All the students were enrolled in a beginning marketing course taught by the same professor. The 45 male and 39 female students were enrolled in the business program at Slippery Rock State College in the Spring of 1980. The students were divided into twenty teams of four each. Student enrollment

being a somewhat variable statistic the final team numbers were: one group of two students, four teams of three students, and fifteen teams of four students. In terms of sex composition four teams were all female, six teams were all male and the remaining ten teams were mixed.

In order to maintain some semblance of objectivity the authors decided that the results when presented needed to involve another variable in addition to the principal one of the sex of the participants. This was necessary to stave off those attacks which could center opposition to the validity of the study by suggesting the results were possibly attributable to some other more powerful variable. The consensus arrived at was to verify the results by using as a variable the average grade point received in the course by the team members. Since the simulation comprised only 25% of the grade for the course it was felt the average team grade could act as a check on the results of the research.

In this simulation five supermarkets (maximum) compete with one another in a single economic area. However, the "customers" from which the supermarkets draw their patronage have the option of shopping outside the "geographic" area if the prices charged by the five supermarkets rise too rapidly or too steeply. The simulation is programmed to act in the reverse as well. Each supermarket shares the existing customer pool equally and is operating at a moderately profitable level at the beginning of the exercise. Similarly all participants begin with the same assets, liabilities, inventories, market share, and so forth. How they carry on from that point becomes the principal objective of the simulation.

In the following tables the teams will be analyzed in terms of (1) sex composition and (2) final grade point average for the course. Each of these major variables will be juxtaposed against weekly and final profit figures for the three team categories: (1) female, (2) male and (3) mixed.

Obviously twenty teams at one institution in one semester are not sufficient data upon which to base permanent conclusions but that is not really the purpose of the research. The purpose is to shed some light on an area of simulation which heretofore has not been discussed to any meaningful extent in the simulation literature. The question which can be answered to some extent by this research pertains to the advantages accruing to simulation instructors from having a more thorough knowledge of the impact on the success of the simulation caused by the sexual composition of the teams.

RESULTS

In Table I the null hypothesis of "no difference in profit levels based on the sex composition of the simulation teams" has to be rejected. Some qualification in terms of conclusions is in order at this point. While it is possible to conclude there is a difference in profit levels which can be attributed to the sex composition of the simulation teams, this conclusion is limited to teams of all the same sex. In those cases where there are teams of mixed sex the absolute number of females or males in a particular team is not significant in terms of the achievement level of the team. While mathematical averages can be misleading the results presented in Table II show a definite degree of simulation superiority on the part of female teams. Turning to Table III and Diagram A, an analysis of the results of the twenty teams when arranged in terms of the sex composition of the teams reveals the following ranges: for female teams the profit or loss ranges from -$1473 to +$3452, for male teams the profit/loss range is from -$5638 to +$1342, for the mixed teams the profit/loss range is from -$6006 to +$2439. The authors believe it is of greater relevance to this study to place more attention on the range of the simulation results than on the straight averages. In such a case the results displayed by the female teams remain as impressive as when the

mathematical averages are used.

At this point it is in order to ask an additional question concerning the part grade point averages might have played in the results presented in Tables I, II, and III. Thus the final grade in the class for each student was averaged for each team to see if there was a correlation more tangible than the sex composition of the individual teams. Since the results of the simulation accounted for 25% of the course final grade some overlap was inevitable. It was thought the remaining 75% was strong enough upon which to base a check of the original findings. The relationship between profit levels and team grade point is presented in Table IV. Here the Chi Square statistic does not meet acceptable levels of significance. The null hypothesis of "no difference" could not be rejected.

Similarly in Diagram A the results of Tables I and IV are combined to show profit and loss levels compared with team grade point and the sex composition of each team. The first observation is that there is not a particularly close relationship between grade point and simulation profitability performance except that the two highest rated teams academically were in the profitable range. On the other hand the 2.50 to 2.75 academic grouping had three of the six teams in the category operating profitably. Obviously substantive conclusions are most difficult to arrive at when using the data presented in Diagram A.

Thus the research concludes with the observation that the average female team in this investigation outperformed male and mixed sex teams. The effect of team grade point appears to be for the most part irrelevant in terms of team performance. By extending the analysis a bit further the authors conclude that the number of females on a mixed sex team has no significant impact on the profit performance of the team. In somewhat more gross terms when the

results are divided into profit or loss and when the degrees of profit or loss are ignored, the results taken from Table III show that of the four female teams two were profitable and two were unprofitable; of the six male teams three were profitable and three were unprofitable; and of the ten teams of mixed sex three were profitable while seven suffered losses. From this it might be concluded (although the authors are more than a bit reluctant to do so) that mixed sex simulation teams do not function in terms of profitability on this particular simulation as well as single sex teams do.

Obviously, much more research remains to be done in this area. As of this moment in the research the inescapable conclusion which can be drawn from these results is that single sex simulation teams perform better than mixed sex teams. Whether it is legitimate to conclude that single sex teams derive greater educational and learning benefits is very much questionable at this very early stage of the research.

In conclusion the authors invite, perhaps even challenge, you to embark on similar research. The winners will be all those who believe in and use simulation techniques to enhance the educational process.

TABLE I

RELATIONSHIP BETWEEN COMPOSITION OF THE TEAM AND SIMULATION PERFORMANCE (PROFIT OR LOSS)

Team Composition	-$2000 to -$4000+		0 to -$2000		0 to +$2000		+$2000 to +$4000+	
	n	%	n	%	n	%	n	%
All Male	2	33	1	17	3	50	0	0
All Female	0	0	2	50	1	25	1	25
Mixed	5	50	2	20	2	20	1	10

Chi Square = 21.419 sig. at .05 level.

TABLE II

AVERAGE PROFIT OR LOSS FOR EACH TEAM CATEGORY

Team Composition		Profit or loss (average for all teams in category)
Mixed	10 teams	-$1467.66
All Male	6 teams	-$1370.49
All Female	4 teams	+$0376.32

TABLE III

GROUP COMPOSITION, TEAM NUMBER, GROUP GRADE POINT AVERAGE AND TOTAL PROFIT OR LOSS

Team No.	Males	Females	Group G.P.A.	Profits or losses
1	3	1	2.50	+1674.22
2	4	0	2.75	+ 696.26
3	3	1	2.00	-1777.52
4	3	1	2.25	+1307.05
5	0	4	2.00	+ 26.86
6	4	0	2.00	-1219.93
7	2	2	3.00	-2247.29
8	1	3	2.75	-2158.21
9	4	0	3.50	+ 993.99
10	3	0	3.00	-4397.09
11	1	1	2.00	-3282.25
12	3	1	2.00	- 818.84
13	2	1	2.66	-6006.42
14	0	4	3.50	+3452.51
15	0	4	2.00	-1472.60
16	2	2	2.75	+2429.70
17	0	3	2.66	- 501.47
18	3	1	2.25	-3797.04
19	4	0	2.25	+1342.20
20	3	0	2.00	-5638.40

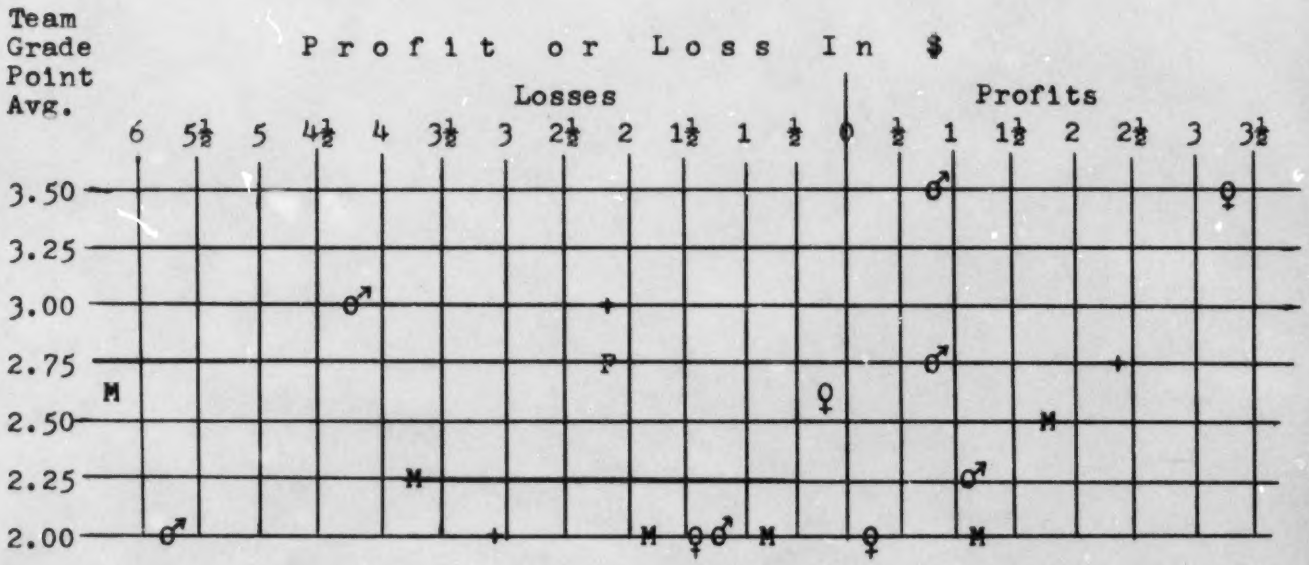
TABLE IV

RELATIONSHIP BETWEEN PROFIT/LOSS LEVELS AND GRADE POINT AVERAGE FOR EACH TEAM

Grade Point for the Course	Profit/Loss							
	-$4000+ to -$2000		-$2000 to 0		0 to +$2000		+$2000 to +$4000	
	n	%	n	%	n	%	n	%
2.5	43	30	4	40	3	30	0	0
2.6 to 2.99	2	39	1	17	2	33	1	17
3.0 and above	2	50	0	0	1	25	1	25
	Chi Square = 17.87, not significant level							

DIAGRAM A

SCATTER DIAGRAM ILLUSTRATING THE RELATIONSHIP AMONG
TEAM GRADE POINT, TEAM COMPOSITION AND SIMULATION PERFORMANCE



Team Composition Symbols	No. of Teams	Profit or Loss Range	Grade Point Average Range
O = Female	4	-$1473 to +$3453	2.0 to 3.5
O = Male	6	-$5638 to +$1342	2.0 to 3.5
+ = Evenly divided	3	-$3282 to +$2430	2.0 to 3.0
F = Majority female	1		
M = Majority male	6	-$6006 to +$1674	2.0 to 2.66

TABLE V

WEEKLY RECORD FOR EACH OF THE SIMULATION TEAMS

Team No.	1	2	3	4	5	6	7	8	9	Total*
1	+118	-638	-183	+213	+544	+451	+405	+402	+361	+1674
2	+349	+405	+101	+ 25	+363	+272	-149	-167	-310	+ 696
3	+190	+383	+321	+ 29	-564	-488	-429	-261	-958	-1778
4	+324	+501	-118	+158	+245	+228	+ 24	- 53	- 2	+1307
5	+230	+413	-142	+110	-665	-230	+ 63	+ 78	+117	+ 27
6	+306	+472	+272	- 70	+ 16	-205	-546	-854	-611	-1220
7	-104	+476	+166	- 30	-307	-143	-167	-1162	-976	-2247
8	+101	+195	-529	-182	-229	+ 46	-552	-646	-361	-2158
9	-1039	+428	+ 47	-223	+248	+817	+676	+211	-149	+ 994
10	+ 78	+229	-268	-2023	-448	-346	-634	-562	-423	-4397
11	-1142	-566	-400	-264	-261	-165	-416	- 41	- 28	-3282
12	+252	+100	- 46	+182	-360	+ 5	-622	- 85	-245	- 819
13	+128	+397	+ 21	-1318	-1048	-324	-1578	-1434	-851	-6006
14	+289	+290	+195	+156	+208	+413	+591	+755	+557	+3453
15	+162	+ 38	+ 93	- 83	- 86	-327	-532	-411	-327	-1473
16	+556	+652	-152	-240	+ 2	+244	+464	+397	+508	+2430
17	- 54	+411	+218	-294	-119	- 70	-122	-223	-249	- 501
18	-338	-532	-648	-484	-573	-286	-568	-425	+ 58	-3797
19	+375	+562	+188	+428	- 15	+188	- 7	-100	-279	+1342
20	- 80	+221	-445	-270	-725	-605	-297	-2067	-1371	-5638

*All Totals have been rounded to nearest dollar figure.

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